Open book, open notes, open computer, but closed mouth!
Write all answers on these sheets.

<table>
<thead>
<tr>
<th>question</th>
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<td>maximum</td>
<td>15</td>
<td>10</td>
<td>15</td>
<td>15</td>
<td>20</td>
<td>15</td>
<td>10</td>
<td>100</td>
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1. Consider the sum \( \sum_{k \geq 1} \frac{1}{2^k - 1} \).

   Give the Maple command to create a function to compute a numerical approximation of this sum. The function (call it \( sNd \)) must take two arguments:
   - \( N \) : the number of terms in the sum; and
   - \( d \) : the number of digits in the approximation.

   Do \( sNd(20,100) \); and report the last digit you see.

2. Explain what the command \texttt{map} does. Give an example of a good use.
3. The $n$-th Chebychev polynomial is also often defined as $\cos(n \arccos(x))$.

Give the definition of the procedure $C$ which takes on input $x$ and has index $n$.
Thus $C[n](x)$ returns $\cos(n \arccos(x))$ while $C[10](0.5)$ returns the value of the 10-th Chebychev polynomial at 0.5. Compare this value with $\text{orthopoly}[T](10,0.5)$.

4. What is the difference between $\text{diff}$ and $D$?

Give an example where $\text{diff}$ must be used instead of $D$:

Give an example where $D$ must be used instead of $\text{diff}$:
5. Let $a$ and $b$ be positive numbers. Consider $f = \frac{x^2}{a} + \frac{y^2}{b}$ and the unit circle $x^2 + y^2 = 1$.

Give all Maple commands . . .

(a) to determine the number of extremal values of $f$ on the unit circle.

(b) to show how to compute one (only one!) such extremal value.
6. Consider the curve $x^4 - 3xy + y^4$. Give all Maple commands

(a) to make a plot for $x$ and $y$ both ranging between $-2$ and $+2$.

(b) to convert the curve into polar coordinates.

(c) to plot the curve in polar coordinates.

7. The $(i, j)$-th entry in a Vandermonde matrix is defined as $x_i^{j-1}$.

Give the Maple command to make a 3-by-3 Vandermonde matrix.